An Electon-capture-delayed Fission Study of ^{232}Am

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An ^{232}Am Electron-capture-delayed fission (ECDF) experiment was performed at the 88-Inch Cyclotron. The ^{237}Np(^{3}He^{2+},8n)^{232}Am reaction with 75 MeV projectiles at an average beam current of around 5 particle μA was used. Previous work has been performed on this isotope by Hall [1]. He preformed a comprehensive study on the fission properties of the ^{232}Am ECDF process and measured the EC half-life of ^{232}Am.

The goal of this experiment was to search for gamma transitions within the second well of the nuclear potential. Based on results from earlier measurements of the K x-rays in coincidence with delayed fission fragments, we have found that in certain regions of N and Z the fission process is slow enough for the K-vacancies left by the electron capture of the precursor to fill. The most likely explanation for this delay is that the ECDF process is proceeding through the fission shape isomer in the EC daughter. The observation of some common gamma transitions in coincidence with K x-rays would be indicative of transitions within the second well.

The LIM2 target system [2] was used to hold the eleven ^{237}Np targets. After flowing through the LIM2 target system, the He jet flowed through a capillary tube to the The Sample Changer System [3] collection site. The samples were then transported to an array of 2 Low-energy Photon Spectrometers (LEPS), 2 High-purity germanium detectors, and 2 ion-implanted silicon particle detectors. The GOOSY acquisition system was used to gate on 1877 fission events in the top Si particle detector. The coincident γ/x-ray spectra were studied for peaks above the gamma continuum that would signal gamma transitions in the ^{232}Pu daughter. The γ/x-ray spectra from the LEPS detectors are shown in fig. 1.

The dominant peaks in the spectrum are the 99 and 103.5 keV Pu K_α x-rays and the 116-

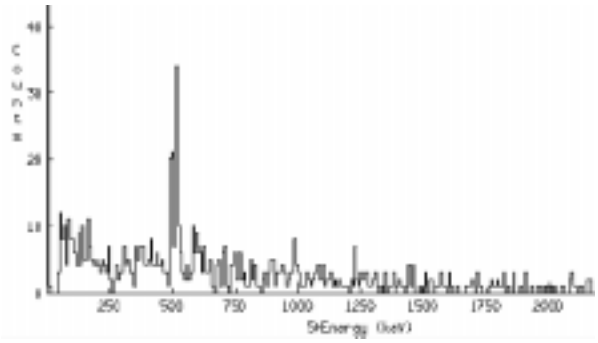

Figure 1: γ/x-rays from the LEPS detector that are coincident with fission events.

120 keV region corresponding to the K_β x-rays. There are some tantalizing peaks at 198 and 245 keV, but without greater statistics no conclusions can be made about the origins of these peaks. If the fission shape isomer in ^{232}Pu has a deformation similar to neighboring nuclei on the *Chart of the Nuclides*, rotational transitions with energies around 20, 50, 85, 110, and 140 keV would be expected. The fact that internal conversion is expected to compete heavily with γ transitions for the low energy transitions may account for the low statistics seen in these results.

References

[1] H.L. Hall, et al., Phys. Rev. C 42 (1990) 1480.

[2] D.A. Strellis, et al. 1999 NSD Annual Report.

[3] *accepted for publication:* D.A. Strellis, et al., Nucl. Inst. Meth. A, (2000).